

MAINTENANCE OF AIR SAMPLING PUMPS

Purpose This Air Quality Group procedure describes the steps to rebuild, replace parts, perform preventive maintenance, test, and prepare new Gast vacuum pumps for service for the AIRNET monitoring system.

Scope This procedure applies to the rebuilding, testing, preparation, and preventive maintenance performed on the air pumps used to sample air as part of the AIRNET project.

In this procedure This procedure addresses the following major topics:

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General information about this procedure

Attachments This procedure has the following attachments:

Number	Attachment Title	No. of pages
1	Exploded View of Pump and Parts	2

History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	12/18/95	New document.
1	9/24/96	Added steps describing bearing replacement.
2	7/16/97	Added more steps and details on power cord installation and bearing replacement.
3	1/25/99	Added caution about hearing damage and rules for operating pumps inside Cave, requirement for wearing steel-toed shoes when carrying pumps, and note on bearing failures in Emerson motors.
4	4/27/99	Added some steps and clarified other steps to add more detail.

Who requires training to this procedure?

The following personnel require training before implementing this procedure:

- ESH-17 employee assigned to perform pump maintenance

Training method

The training method for this procedure is on-the-job training conducted by a previously trained individual and is documented in accordance with the procedure for training (ESH-17-024).

Hazard Control Plan

The Hazard Control Plan that documents the hazards of work described in this procedure is:

- HCP-ESH-17-206, R4

This plan is on file in the ESH-17 group office.

General information, continued

References

The following documents are referenced in this procedure:

- ESH-17-011, “Logbook Use and Control”
- ESH-17-024, “Personnel Training”

Note

Actions specified within this procedure, unless preceded with “should” or “may,” are to be considered mandatory guidance (i.e., “shall”).

Servicing a pump

Description of pump	The Gast vacuum pump model number 1023-101Q is an oil-less vane-type pump connected to a ¾ hp GE or Emerson electric motor.
Spare parts	<p>Keep the following minimum inventory of parts on hand. Refer to the parts list in Attachment 1 for part numbers.</p> <ul style="list-style-type: none">• 10 O-rings (part number 58075-2-126 [Parker] or part number AK473 [Gast])• 50 filters (part number AK524)• 10 gaskets (part number AK522)• 100 vanes (part number AK513)
Note on bearing types	In late 1996, a bearing with “high temperature” grease (“DC-44”) was purchased. The grease was very thick and these bearings lasted only about 1000 hours. The original specification bearing has been used since about April 1997.
Note on motor bearing failures	<p>Starting about mid-1998, the manufacturer supplied pumps with Emerson motors with a machined groove and washer to act as the bearing stop on the motor shaft. A washer was placed on the stop and the bearing pressed onto the washer. It is suspected that, because the washer does not sit exactly centered on the stop, the bearing is not supported squarely and thus fails after 4000 to 12000 hours.</p> <p>It is recommended that only pumps with GE motors be ordered until this bearing support design is changed in the Emerson motors.</p>
Ordering spare parts	Order parts needed by calling the Gast Manufacturing service representative at 310-404-2721. Refer to the parts list in Attachment 1 for part numbers.
Number of spare pumps	In order to keep a sufficient number of pumps available for six-month replacement, keep a minimum of 20 serviced pumps on the shelf.
Required safety equipment	Wear steel-toed shoes <u>anytime</u> you are carrying or lifting pumps.

Servicing a pump, continued

Parts and equipment

Assemble the following parts and equipment before starting work on a pump:

- 1/4" or 3/8" drive socket set
- gasket scraper
- philips screwdriver
- straight screwdriver
- 9 piece open end wrench set
- feeler gauge set
- torque wrench (1/4" drive, reading to at least 100 inch-pounds)
- 2 new filters
- 2 new o-rings
- 4 new pump vanes
- vacuum gauge
- safety glasses

If bearings are to be replaced:

- hydraulic press
- new bearings (#6205 and #6203)
- bearing heater
- new end shield plate
- tool tube (#777)
- temp-indicating marker

Steps to rebuild pump

To rebuild the pump, perform the following steps:

Step	Action
1	Remove the two end caps from the muffler box.
2	Remove the filters from the end caps. If the filter material has stiffened, replace with new filters.
3	Remove muffler box from end plate; be careful not to damage gasket.
4	Remove end plate from body.
5	Remove shroud from electric motor.
6	Remove four vanes from rotor; observe the orientation of the vane contact surfaces for later reassembly.
7	Clean all parts with Fantastic cleaner before reassembling.
8	In the hood, blow dust from all parts with compressed air. Wear safety glasses or keep hood door lowered as far as possible.
9	Check the condition of O-rings (on filters) and gaskets. Replace any O-rings that exhibit faint cracks when gently bent or seem stiffer than new O-rings. Replace gaskets that appear cracked.
10	If the rotor is stiff to turn or if the bearing hours are between 12,000 and 15,000, remove the shaft and replace inner and outer bearings by following steps 11 through 26. If the bearings do not need to be replaced , go to step 27.
11	Remove the bolts holding the body using 3/16" allen wrench. Remove the body.
12	Remove rotor from shaft using the three-finger puller.

Servicing a pump, continued

Step	Action
13	Remove the 4 through-bolts and the end shield from the electrical motor.
14	Remove the electrical motor shaft using a hammer and a 6" steel rod, making sure spring washers are kept in place. NOTE: If the spring washers are released, refer to Attachment 1 for proper reassembly.
15	Place motor shaft in the hydraulic press and remove the rotor using a 6" rod. Hold shaft while slowly pressing. Then remove the inner and outer bearings using the three-finger puller on the vise.
16	In the hood, blow dust from the rotor and the motor housing with compressed air. Wear safety glasses or keep hood door lowered as far as possible.
17	CAUTION: Burns from heated bearing are possible. Wear thermal gloves to handle bearing. Ensure wire guard is in place when heating bearing. Place new inner bearing (#6205) on bearing heater. Mark bearing side with chalk indicator. Leave bearing on heater until indicator chalk changes color to dark blue. Use thermal gloves to pick up bearing and quickly drop straight on shaft.
18	Turn motor shaft around and repeat step 18 to install outer bearing (#6203). If bearing does not slide on, use press.
19	Place motor shaft back into electrical motor housing. Ensure the round shim springs under the outer bearing are re-installed properly.
20	Install a new end shield, the inside pump end-plate, and the four through-bolts. Install nuts.
21	Torque the through-bolts to 30 in-pounds.
22	Using a dial indicator mounted on a sleeve that can be attached to the shaft, check that the end plate is flat within 0.001" as the shaft is turned through one revolution. To adjust, tighten the through-bolt on the side of the plate that is high. If the tolerance cannot be obtained after torquing any bolts to a maximum of 50 in-pounds, loosen the bolts and insert a shim under the plate on the low side; this also may require a new end shield.
23	Slip a new control ring onto shaft and place electrical motor housing onto shelf of hydraulic press..
24	With the press, press rotor over control ring and into place on the shaft with a clearance of 0.002" and no more than 0.003" (check with feeler gauge) between rotor and bearing housing.
25	Reattach body to electrical motor housing using the two allen-head bolts.

Servicing a pump, continued

Step	Action
26	Adjust the top clearance (between rotor and body) to factory specifications (0.002" and no more 0.003") by a) loosening body bolts and b) lightly tapping on the pump body while turning the rotor. Turn the rotor and assure that all points on the rotor clear the body.
27	Replace the shroud, the carbon vanes, and the end plate (6 bolts) loosely.
28	Ensure the muffler housing gasket is installed straight and not pinched. Ensure the O-rings on the endcap make a good seal on muffler box. Torque the body, end plate, and muffler box bolts to 100 in-pounds. Reinsert filters.
29	<p>To ensure the reassembled pump was assembled correctly and that it will develop sufficient vacuum, connect the vacuum gauge to the inlet port and run the pump for a minimum of five minutes. Test pumps with new bearings for a minimum of 24 hours. Ensure the vacuum gauge maintains at least 21" of vacuum at the end of the test.</p> <p>CAUTION: Operating the vacuum pumps inside the Cave for long periods may cause permanent hearing damage.</p> <p>Conduct long-term pump tests outdoors. Pumps may be operated <u>inside</u> the Cave building only for a maximum of two minutes during work hours OR overnight. At the start of each work day, turn off any operating pumps and run them outside the building, if needed.</p>
30	If the pump fails the test, remove endplate and install new vanes. If endplate is scored, regrind or replace and have the bearings replaced as described in steps 11 through 25. Remove and inspect body; if scored, replace. Remove and inspect rotor; if scored, replace. Reassemble and re-test. If second test fails, scrap the pump.
31	Record in the pump log book and in the electronic database the identifier of the pump, the maintenance performed on it, and the date. Make all logbook entries in compliance with the procedure for logbooks (ESH-17-011).
32	Store pumps in the appropriate storage area (TA-54-1001).

Preparing a new pump for service

New pumps When a new pump is received, it requires installation of supporting feet and power cord.

**Steps to
prepare a new
pump**

To prepare a new pump for first service, perform the following steps:

Step	Action
1	Assign an identifier to the pump and mark the pump with the identifier.
2	Install supporting feet.
3	Obtain power cord (16-3 AWG U-L) from Mesa equipment (or subsequent supplier).
4	Take off electrical cover plate from rear of motor and connect power cord to motor. Refer to the low-voltage diagram on motor case.
5	Using a volt-ohm meter, make sure motor is grounded. Test between the ground prong on the plug and the motor case. If no reading is obtained, check the ground connection on the pump.
6	<p>Connect vacuum gage to the inlet port and run the pump for a minimum of five minutes. Ensure the vacuum gage reads at least 21" of vacuum at the end of the test.</p> <p>CAUTION: Operating the vacuum pumps inside the Cave may cause long-term hearing damage.</p> <p>Conduct long-term pump tests outdoors. Pumps may be operated <u>inside</u> the Cave building only for a maximum of two minutes during work hours OR overnight. At the start of each work day, turn off any operating pumps and run them outside the building, if needed.</p>
7	If the pump fails the test, return pump to factory for servicing (Gast Manufacturing Corp., 2300 Highway M-139, Benton Harbor, MI 49023-0097; phone 616-926-6171).
8	Record in the pump log book and in the electronic database the identifier of the new pump, the preparation steps performed on it, and the date. Make all logbook entries in compliance with the procedure for logbooks (ESH-17-011).
9	Store pumps on the shelf in the appropriate storage area (TA-54-1001).

Records resulting from this procedure

Records

The following records are generated as a result of this procedure:

- entries in pump log book and electronic database (book will be submitted pursuant to ESH-17-011)

EXPLODED VIEW OF PUMP AND PARTS

Paste diagram of pump here....

